# I. BACKGROUND OF INVENTION

## IIA. RELATED APPLICATIONS

There are no applications related hereto heretofore filed in this or in any foreign country by the Applicant.

## IIB. FIELD OF INVENTION

My invention relates generally to a ground-supported mower having two in-line wheels and a motorized laterally extending pivotally mounted sickle bar cutter adjustably movable vertically and pivotally in a vertical plane.

## IIC. BACKGROUND AND DESCRIPTION OF PRIOR ART

Lawns and lawn-like herbage structures have been a desirable element of landscape architecture since its earliest times and various tools such as mowers and other mechanical cutters have long been known to maintain the herbage in a uniformly trimmed and aesthetically pleasing state.

Many, if not most, herbage structures heretofore existent have been of a reasonably planar nature and in general of a somewhat horizontal orientation probably to some degree because of the potential for easier creation and maintenance of this type of structure. Many of the mowers for use on this type of an herbage structure have been particularly adapted and designed for use on substantially planar horizontal structures. Two of the most common type of such modern day mowers are the reel type mower having a cylindrical cutter head rotatable

about an axis parallel to an associated cutting bar and generally parallel to a surface supporting the mower and the presently more popular rotary mower having a cutting blade rotating about an axis substantially perpendicular to a surface supporting the mower. Both of these mower types generally are supported at at least three spaced sets of rotatable wheels or rollers that tend to maintain the cutting plane of the mower parallel to a plane extending through the three points of contact of the mower with an underlying supporting surface. This structure in essence makes these types of mowers effectively operable only on substantially planar surfaces of a reasonably horizontal orientation because the mower will tend to move in a straight line only on an underlying horizontal planar supporting surface and will tend to move angularly to a contour line on a sloping surface if the mower moves without slippage of its rolling elements on the supporting surface.

Often herbage structures are created on somewhat regular surfaces that are curvilinear in two or three mutually perpendicular planes, such as on the surface of a hill or ridge of non-uniform curvature. On such surfaces it is generally most convenient and desirable to mow vegetation in a patternation such as on contour lines, on parallel lines uniformly angulated to contour lines or on lines uniformly spaced from the periphery or some portion thereof of the herbage structure being mowed. In each case the use of a

traditional reel or rotary mower is not particularly practical or desirable as either type of mower by reason of its at least three point rolling support will tend to follow a straight line course tangent to a curve sought to be transversed. The mower can be maintained on a curvilinear course only by manually manipulating the mower to continuously change steerage or to cause slippage of the wheels supporting the lower on the underlying surface, either of which manipulation often are difficult to accomplish. If a mower supported on rolling supports journaled on spaced laterally extending axles or a single elongately extending axle moves on a contour line of a hill, the wheel on the higher side of the hill will traverse a course having a shorter length than that traversed by the wheel or roller portion on the lower side of the hill to cause the mower to follow a course tangential to the hill contour rather than to follow along that contour.

To resolve this problem the instant mower provides two relatively thin wheels for support on an underlying surface, but provides those wheels in an elongately spaced co-planar relationship, so that each wheel traverses substantially the same distance along a contour line of a hill over which the mower moves. This elongately spaced co-planar wheel structure provides substantially the same stability of motion and ease of steerage over a curvilinear course that the traditional two

elongately spaced sets of two laterally spaced wheels or rollers do over a linear course on a planar surface.

Mower structures having a single support wheel for locomotion have heretofore been known. With single wheel mowers, however, the horizontal orientation of the mower frame in a plane through the supporting the wheel must be continuously controlled by an operator, whereas with two elongately spaced co-planar wheels the horizontal orientation is more constant and need not be continuously controlled by the operator to provide more accurate and easier operation of the mower having two elongately spaced wheels.

It is desirable, and nearly necessary for practical use, that a mower have means for adjusting the height of a cut surface of herbage relative to the supporting surface beneath the mower in which the herbage grows. In general in both the common reel and rotary type mowers this adjustment has been provided by adjusting the vertical position of the body of the mower relative to the wheels supporting the mower body on the underlying surface. This type of adjustment has often proven cumbersome, difficult and inaccurate in mowers having multiple wheels, as generally structures supporting each wheel, or at least each opposed pair of wheels, must be adjusted relative to the mower body for any substantial amount of vertical adjustment. In some mowers smaller amounts of vertical adjustment have been accomplished by adjusting only one set of

elongately spaced wheels relative to the other so that the mower body carrying the cutting device is angulated in an elongate direction, but doing this generally can provide only a limited vertical adjustment and may cause problems in the cutting operation, in providing a uniform cut surface and in avoiding small irregularities extending upwardly from the general underlying earth surface.

The instant mower solves this problem in a different fashion by providing a columnar type powering structure mounted on the mower frame for adjustable vertical positioning relative to the frame to allow vertical adjustment of cutter structure carried by the powering structure relative to the frame rather than changing the amount of dependency of the supporting wheels relative to the frame. To accomplish this adjustment the powering structure provides a vertical column for support on the mower frame with a motor at the upper portion of the column, a power shaft communicating vertically powering downward through the column and a sickle type mowing bar carried at the lower portion of the powering column to operatively communicating with the shaft so that the whole powering structure may be moved vertically relative to the supporting mower frame to adjustably regulate the cutting level.

For a mower having a cutter structure extending laterally from the mower frame to operate on an angulated surface by

following contour lines and provide a uniformly cut vegetative surface substantially parallel to the earth supporting the herbage structure, it is necessary that the mower frame be angulated from the vertical or that the cutter structure be angulated relative to the mower frame. The instant mower provides pivotal mounting for the cutter structure on the powering column to allow adjustable pivotal motion of a cutter bar in a vertical laterally extending plane to provide the desired cut surface of herbage. To accommodate this motion of the cutting head it is driven through an angulated gear type transmission linkage with the powering shaft, which remains in continuous mechanical interconnection through a substantial pivotal motion of the cutting head of at least 120°.

Often herbage on steeper surfaces is of a heavier and more coarse nature than vegetation on substantially flat lawns. By reason of this the instant mower provides a reciprocating sickle bar type cutter structure that preferably has two notched blades that reciprocate relative to each other to cut herbage in the notches of the blades as they move relative to each other. This type of sickle bar cutter allows the instant mower cut coarser herbaceous material such as large overgrown grass plants and smaller bushes, brush and vines while yet cutting finer lawn grass stems as well as the common present day reel and rotary type mowers. It also is often convenient in cutting herbaceous material on sloped surfaces to be able to

cut that material in either a forward or rearward direction. To accommodate this function the instant cutter bar is of a double-sided type having notched tooth structures as described on both the forward side and the rearward side of the sickle bar.

The structure of the instant invention is also such as to allow ready folding or unfolding between a more compact mode for storage and a less compact assembled form for use, while still providing all of the other described use features.

My invention resides not in any one of the foregoing features individually, but rather in the synergistic combination of all of its structures that necessarily give rise to the functions flowing therefrom as herein specified and claimed.

## III. SUMMARY OF INVENTION

The instant provides a peripherally defined frame having a rearward upwardly extending manipulating handle and journaling two elongately spaced co-planar wheels at each end of the frame for ground support. The medial portion of the frame between the wheels carries a vertically oriented powering structure having a medial powering column supported for adjustable vertical positioning on the frame with a motor at the upper portion of the powering column operatively communicating with a powering shaft depending through the powering column and

carrying a transmission structure at the lower portion of the powering column. The transmission structure pivotally carries a double-edged sickle bar type cutter extending laterally therefrom for adjustable angular positioning in a vertical laterally extending plane while remaining in operative interconnection with the transmission structure to provide reciprocal oscillatory motion of two adjacent cutter blades in the sickle bar. The mower optionally may be of a foldable nature to provide a less bulky structure for storage or transport during periods of non-use and a fully assembled structure for use.

In creating such a mechanism:

A principal object is to provide a mower to effectively cut both finer vegetation and coarser herbage on sloped terrain by use of a laterally extending sickle-cutting bar.

A further object is to provide such a mower having a frame with an upwardly and rearwardly extending manipulative handle and two elongately spaced co-planar medially positioned supporting wheels.

A further object is to provide such a mower having a powering structure, with a medial powering column carried by the mower frame for adjustable vertical positioning relative to the mower frame.

A further object is to provide such a mower wherein the powering structure has a vertical column with a motor at its upper end portion communicating by a powering shaft depending through the column with a transmission structure in its lower end portion pivotally mounting a sickle bar for motion in a laterally extending vertical plane.

A further object is to provide a bevel gear type transmission communicating between the power shaft and the sickle bar that allows angular pivotal motion of the sickle bar while maintaining continuous geared communication between the sickle bar and the power shaft.

A still further object is to provide such a mower with pivotal adjustable motion of the sickle bar between a plurality of user selectable angular positions.

A still further object is to provide such a mower that has a double-edged oscillating sickle bar that cuts in either a forward or rearward direction.

A still further object is to provide such a mower that is of new and novel design, of rugged and durable nature, of simple and economic manufacture and otherwise well suited to the uses and purposes of which it is intended.

Other and further objects of my invention will appear from the following specification and accompanying drawings which

form a part hereof. In carrying out the objects of my invention, however, it is to be understood that its essential features are susceptible of change in design and structural arrangement with only one preferred and practical embodiment of the best known mode being illustrated and specified as is required.

## IV. BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings which form a part hereof and wherein like numbers of references refer to similar parts throughout:

Figure 1 is a forward looking isometric view of the right side of the mower with the sickle bar in a horizontal position.

Figure 2 is a forward looking isometric view taken from the same view point as Figure 1 showing the sickle bar in an upwardly angulated position.

Figure 3 is an orthographic rear elevational view of the mower of Figure 1 showing the sickle bar in phantom outline in an upwardly angled position such as that shown in Figure 2.

Figures 4 shows the folding of the mower to more compact structure for storage or transport, with Figure 4A presenting a rearward looking isometric view of the left side with the sickle bar horizontally extended, Figure 4B presenting a forward looking view of the right side with the sickle bar and handle folded and Figure 4C presenting an orthographic right side elevational view with the handle and sickle bar in folded mode.

Figure 5 is an enlarged partially cut-away isometric view of a first form of lower transmission structure for oscillating

a single cutting blade relative to a stationary notched cutting bar.

Figure 6 is an enlarged lateral cross-sectional view through the transmission and sickle bar structure of Figure 5 having two adjacent reciprocally oscillating toothed cutter bars, taken on line 6-6 in Figure 5 in the direction indicated by the arrows.

Figure 7 is an enlarged partially cut away isometric view of the transmission structure embodying a second commonly known mechanical linkage to oscillate two adjacent reciprocating toothed cutting blades relative to each other with the drive shaft angled at an included angle to the sickle bar structure greater than 90°.

Figure 8 is an enlarged partial vertical cross-sectional view through the mechanism of Figure 7, taken on the line 8-8 thereon in direction indicated by the arrows.

Figure 9 is an enlarged horizontal cross-sectional view through the mechanism of Figure 7, taken on the line 9-9 thereon in the direction indicated by the arrows.

## V. DESCRIPTION OF THE PREFERRED EMBODIMENT

As shown in Figure 1, ground supported frame **10** carries medial vertical adjustably positionable power structure **11** having in its lower portion transmission **12** and pivotally carrying laterally extendable sickle bar **13**.

Frame **10** is formed with two similar side beams having linear medial portions **14**, somewhat more angulated upturned rearward portions **15** and somewhat less angulated upturned forward portions **16**. Forward ends of forward portions **16** are joined in laterally spaced relationship by forward cross beam **17** and the rearward ends of rearward portions **15** are joined in similar laterally spaced relationship by rearward cross beam **18**. The medial portions **14** of the side beams are joined by angle type medial cross beam **19** to create the structurally interconnected frame **10** illustrated. The angulation and dimensioning of rearward portions **15** and forward portions **16** of the side beams is such as to allow rotation of forward wheel **20** and rearward wheel **21** that support the frame for locomotion over a supporting surface. Wheels **20,21** are supported for rotation in bearing type journals **22** carried by brackets **23** depending from each respective end of medial portions **14** of the side beams. The wheels **20,21** are aligned in a vertically elongate plane extending medially between the side beams **14**.

The dimensioning and configuration of wheels **20,21** and forward and rearward portions **15,16** of the side beams are so determined that the wheels **20,21** may freely rotate in their journals **22** without interference from forward and rearward cross-beams **17,18** respectively or from the side beams **14**.

Frame **10** provides angulated supports **24** extending from the upper part of each rearward portion **15** of each side beam angularly downwardly to the upper surface of the medial part **14** of the associated side beam to provide additional strength and rigidity for the rearward portion of the frame. U-shaped manipulating handle **25** has angulated depending legs **25a** and uppermost handle bar **25b**. The lower portion of each leg **25a** is adjustably pivotably mounted to the laterally outer surfaces of each opposed rearward portion **15** of each side beam by nut-bolt combinations **26**. Preferably nut **26a** has a handle-like configuration to aid manual manipulation in tightening and loosening on the bolt so that the associated bolt may be manipulated to allow folding of the handle structure and adjustment of its angular position relative to the frame **10**.

Powering structure **11** provides tubular powering column **27** slideably mounted for vertical adjustment in collar **28** structurally carried by medial cross-beam **19** of the frame about a hole defined in the horizontal arm of that cross-beam **19** to allow passage of the powering column **27** therethrough. The

powering column collar **28** is of a split type with two spacedly adjacent tightening ears **29** carried on each side of the split to receive nut-bolt combination **30** extending through aligned holes defined in the ears **29** to allow adjustment of the frictional contact of the collar **28** with powering column **27** to allow adjustment of the vertical position of powering column relative to the collar **28** and thusly relative to the frame **10.** Preferably the bolt portion **30a** of nut-bolt combination **30** has a bent shaft portion **30b** to aid manual manipulation in tightening and loosening the nut-bolt combination.

As seen in Figure 5 and 6 the powering column **27** defines medial channel **31** to allow passage of powering shaft **32** therethrough. The powering shaft **32** is journaled in axial alignment in channel **31** by at least one bearing **33,** and preferably by two axially spaced bearings (not shown), carried within channel **31.** The upper portion of powering column **27** operatively communicates with motor **34,** in the instance illustrated comprising a gasoline powered type motor, carried by the upper portion of the powering shaft **32** of the motor **34.** Other types of motors than those powered by fossil fuels are equally well adapted to use with my mower, especially such as electrically powered motors. The motor **34** communicates through appropriate known linking structure carried in depending housing **35** to operatively rotate powering shaft **32** and has

known control devices to allow starting, stopping and speed variation. The operating devices for these controls may be positioned on the motor structure itself or remotely on a manipulating handle **25** as desired.

The lower end portion of powering column **11** carries transmission structure **12** having casement **36** defining chamber **37** for containment of the transmission bearing. The upper portion of casement **36** provides cylindrical split collar **38** to fasten about the lower end portion of powering column **27**. The split collar has fastening ears **39** extending radially outwardly on each side of slit **40** with nut-bolt combinations **41** extending between fastening ears **39** to releasably fasten collar **38** about the outer surface of the lower portion of the powering column **27**. The lower portion of powering shaft **32** carries angled beveled gear **42** to rotate about a vertical axis and intermesh with similar angled bevel gear **43** to translate rotary motion of vertical powering shaft **32** into horizontal rotary motion of jack shaft **44** carrying the bevel gear **43**. The jack shaft **44** is journaled in bearing **45** carried in the forwardly extending jack shaft channel **46** of casement **36** extending forwardly spacedly therebeyond to communicate with the sickle bar structure **13**. The forward end portion of casement **36** defines circularly annular disk **47** to fit adjacent the sickle bar structure and

allow pivotal motion of that structure relative to the transmission structure **12**.

Sickle bar structure **13** provides casement **48a** with disk-like portions that fits immediately forwardly of the forward surface of annular disk **47** of the transmission structure for pivotal motion of the casement **48** in a vertical plane about the axis of jack shaft **44**. The casement **48** defines chamber **49** to carry mechanical linkage communicating between the sickle bar structure and the transmission structure.

The pivotal motion of casement **48** relative to casement **36** may be provided in various fashions, which are within the ambit and scope of my invention. One convenient method is illustrated in Figures 5 and 6 where it is seen that portion **50** of the body of casement **48** extends beneath casement **36** and upwardly along the side of casement **36** distal from casement **48** where that portion **50** is pivotally attached to casement **36** by bolt **51** which is axially aligned with the axis of jack shaft **44**. Other known mechanical linkages which accomplish this function are equally well within the ambient and scope of my invention as the only mechanical requirement is that the casement **48** pivot relative to the casement **36** about the extended axis of jack shaft **44** to allow the sickle bar **13** to pivot and be continuously powered in various angular positions

by powering shaft **32** by use of gearing linkage such as that illustrated.

The flange **47a** carried by angular disk **47** defines a plurality of circumferentially spaced holes **52** and a similar flange **53** on the abutting surface of casement **48** defines a similarly arrayed plurality of circumferentially spaced holes **54** that may be aligned with the holes **52.** Pin **55** (Figure 6) is inserted through two aligned holes **52,54** to maintain the sickle bar casement **48** in a particular desired angular relationship relative to transmission casement **36.** The pin **55** may be manually positionable or may be spring biased and manually controllable from the area of the handle bar **25** by lever **55a** if desired.

A first species of known and commonly used mechanical linkage for translating rotary motion of shaft **44** to a single cutter bar is shown in Figures 5 and 6.

Casement **48** journals vertically oriented split pinion shaft **56** in vertically spacedly opposed bearings **57.** The pinion shaft **56** in its medial upper portion irrotably carries beveled pinion **58** operatively engaged with beveled gear **43** irrotatably carried on the forward end portion of jack shaft **44** to transmit rotary motion of power shaft **32** to pinion shaft **56.**

The lower end portion of the upper part **56a** of pinion shaft **56** and the upper end portion of lower part **56b** of the pinion shaft **56** both irrotably carry sickle bar cams **60**, spaced to movably receive the inner end portion of sickle bar yoke **61** therebetween. The sickle bar yoke **61** is pivotally journaled on sickle bar pin **62** so that the vertical rotary motion of pinion shaft **56** will be translated to perpendicular oscillatory motion of the sickle bar yoke **61** as heretofore known in the sickle bar cutting arts. The sickle bar yoke **61** at its laterally outer end provides yoke legs **63** defining a space therebetween to movably receive the inner end of cutter bar **64** which is journaled between the legs **63** by pin **65** extending through legs **63** and the inner end portion of cutter bar **64**. The cutter bar **64** is an elongate element having a plurality of similar spacedly adjacent triangular teeth **66** (Figure 1) defined on both forward and rearward edges and is carried between two similar support bars **67** for elongate oscillatory motion therebetween to cut vegetation in either a forward or rearward direction.

A second known and commonly used mechanical linkage for translating rotary motion of a shaft perpendicular to two relatively oscillating cutter blades **83** of a sickle bar **13** is shown in Figures 7-9. Here the transmission structure **12** is substantially the same as that described for the first species

of motion translating linkage of Figure 5-6 and its parts are labeled with the same numbers as used for the same parts of the first species to aid understanding.

In this second species of motion translator the sickle bar structure **68** provides casement **69** which is comparable to casement **48** of the first species. The casement **69** carries pinion shaft **70** journaled in vertically spacedly opposed bearings **71.** The pinion shaft **70** irrotatably carries pinion **72** in its medial portion to operatively intermesh with bevel gear **43** carried on jack shaft **44** of the transmission structure **12** to transmit the horizontally oriented rotation of jack shaft **44** to vertically oriented rotation of pinion shaft **70.** A lower portion of pinion shaft **70** irrotatably carries disk gear **73** which in turn intermeshes with idler disk gear **74** journaled on shaft **75** carried by casement **69.** Idler disk gear **74** intermeshes with cutter driving disk gear **76.** The cutter blade driving disk gear **76** is irrotatably carried on shaft **77** supported in vertically spacedly opposed bearings **78** carried by casement **69.**

The shaft **77** irrotatably carries two vertically spaced circular driving cams **79** that are eccentrically carried on the shaft **77** with diametrically opposed eccentricity. Each driving cam **79** is rotatably carried in the laterally end portion of

similar blade yokes **80** in holes **85** defined therein. Each of the elongate blade yokes **80** have vertically spaced legs **81** in their laterally outer end portions defining blade channel **82** to receive the inner end portions of cutter blades **83** therein. The laterally inner end portion of each cutter blade **83** is rotatably mounted in one blade channel **82** by pin **84** extending through holes defined in the blade yoke legs **81** and through hole **84** defined in the blades.

With this linkage as pinion shaft **70** rotates, its rotation will be translated through disk gear **73,74,76** to rotate driving shaft **77**. As driving shaft **77** rotates driving cam **79** will be rotated about the axis of driving shaft **77** and will cause driving cam **79** to rotate eccentrically about the driving shaft **77**. Since the driving cams **79** are rotatably carried in blade yokes **80**, rotation in those blade yokes will be translated into an oscillatory linear motion of the blade yokes with each blade yoke being 180° out of phase with the other. This oscillating motion of the blade yokes **80** will cause resultant oscillatory motion of cutter blades **83** relative to each other and cause a cutting between the teeth **66** of the blades.

The species of sickle bar structures described are known, commercially available and commonly used, especially in hedge and herbage trimmers and are not novel *per se*. Various other

similar known cutter bar structures that accomplish the same purpose and results, such as single cutter bars that oscillate relatively to a fixed tooth cutter bars and sickle bars that have two or more blades that oscillate relatively to each other by means other than those described herein remain within ambit and scope of my mower and are operative therewith though they may not be as efficient or useful as the cutter bar structures described still.

Having described the structure of my mower its operation may be readily understood.

A mower formed according to the foregoing specification, if in a compact mode, is changed manually to an assembled operative mode by releasing the nut-bolt combinations **26**, manually moving the U-shaped manipulating handle **25** to the desired rearwardly extending angulated position for comfortable use and retightening the nut-bolt combinations **26** to maintain this position. The mower then is moved to an area where it is to be used by appropriate manual manipulation as aided by wheels **20,21**, normally with the sickle bar **13** facing upwardly on a sloping surface to be mowed.

The sickle bar **13** then is moved to an angular position that is substantially parallel to the angulated surface of the herbage structure to be mowed. This is accomplished by removing the pin **55** from its fastening position, manually

moving the sickle bar to the appropriate position and re-establishing the pin **55** in holes **52,54** to maintain the desired angular position during the current mowing operation. The vertical position of the surface to be cut by the mower is then determined and established by vertically moving the powering structure **11** relative to the mower frame **10**. This motion is accomplished by loosening nut-bolt combination **30**, manually manipulating the powering structure **11** to the appropriate vertical position and subsequently retightening the nut-bolt combination **30**, as aided by bent portion **30b** and bolt shaft **30a**, to maintain the desired vertical position.

The motor **34** of the powering structure then is started, controlled for appropriate cutting speed and the mower is ready for cutting. To cut an herbage surface the mower is manually manipulated by handle **25** to move along a selected course determined to cut herbage on the surface to be serviced. Preferably the mower is moved either in sequential courses parallel to the periphery, or portion thereof, of the area to be cut or on contour lines of a sloping surface to be cut. The mower easily may be moved on lines angled to either contour lines or lines parallel to any of the periphery of an area to be serviced, but often this operation may not be as simple or efficient as moving the mower in the preferred modes.

It is to be noted from the foregoing description that the sickle bar cutter structure illustrated does not have guards about its exposed teeth. Such guards if desired are well known in the prior art and may be used with my sickle bar cutter without departing from its spirit, essence, or scope, though such guards are not necessary or an essential element for the instant mower or its operation.

Having described a preferred embodiment of the present invention, what is desired to be protected by Letters Patent and what is claimed is: